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ALGEBRA.

175. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, England.

Find the conditions that $\frac{x}{m+3} + \frac{y}{m+1} + \frac{z}{m-z} = 1$, where m may be a, b or c .

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

Let $x = (m+3)u$, $y = (m-1)v$, $z = (m-z)w$.

$\therefore u+v+w=1$. $\therefore u, v, w$ are the areal coördinates of a point. Let d, e, f be the sides of the triangle of reference; then

$$\frac{u}{da} = \frac{v}{e\beta} = \frac{w}{f\gamma} = \frac{1}{2\Delta},$$

where Δ = area of triangle of reference, and $da + e\beta + f\gamma = 2\Delta$.

$$\therefore u = da/2\Delta, \therefore x = \frac{(m+3)da}{2\Delta};$$

$$v = e\beta/2\Delta, \therefore y = \frac{(m-1)e\beta}{2\Delta};$$

$$w = f\gamma/2\Delta, \therefore z = \frac{(m-z)f\gamma}{2\Delta}, \text{ or } z = \frac{mf\gamma}{2\Delta + f\gamma}.$$

$$\therefore \frac{x}{m+3} + \frac{y}{m-1} + \frac{z}{m-z} = \frac{da + e\beta + f\gamma}{2\Delta} = \frac{2\Delta}{2\Delta} = 1, \text{ whatever the value of } m.$$

176. Proposed by MARCUS BAKER, U. S. Geological Survey, Washington, D. C.

Solve $x^2 + y^2 + z^2 = a$(1), $x + y^2 + z^2 = b$(2), $x^2 + y + z^2 = c$(3).

Solution by G. B. M. ZERR, A. M., Ph. D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

Let $x^2 + y^2 + z^2 = s$.

$$\therefore z^2 - z = s - a, \text{ or } z = \frac{1}{2} \pm \sqrt{s - a + \frac{1}{4}} = \frac{1}{2} \pm \sqrt{m - a}.$$

$$x^2 - x = s - b, \text{ or } x = \frac{1}{2} \pm \sqrt{s - b + \frac{1}{4}} = \frac{1}{2} \pm \sqrt{m - b}.$$

$$y^2 - y = s - c, \text{ or } y = \frac{1}{2} \pm \sqrt{s - c + \frac{1}{4}} = \frac{1}{2} \pm \sqrt{m - c}.$$

$$\therefore x^2 + y^2 + z^2 = s = \frac{3}{4} \pm [\sqrt{m - a} + \sqrt{m - b} + \sqrt{m - c}] + 3m - (a + b + c).$$

$$\therefore 2m + 1 - (a + b + c) = \mp [\sqrt{m - a} + \sqrt{m - b} + \sqrt{m - c}].$$

$$\therefore 2m + D \pm \sqrt{m - a} = \mp [\sqrt{m - b} + \sqrt{m - c}] \dots (1). \text{ Squaring (1),}$$

$$4m^2 + (4D - 1)m + D^2 + b + c - a = 2\{\sqrt{[(m - b)(m - c)]}$$

$$\mp (2m + D)\sqrt{m - a}\} \dots (2).$$